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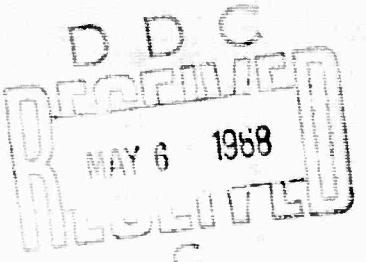
MONTHLY
MICROCLIMATIC SUMMARY

JUNE 1967

ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

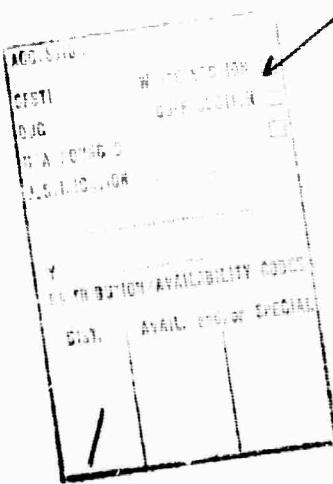
US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone



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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

JUNE 1967

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USATECOM Project No. 9-4-0013-C1

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MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N	79° 33'W
Chiva Chiva	09° 01'N	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semianual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

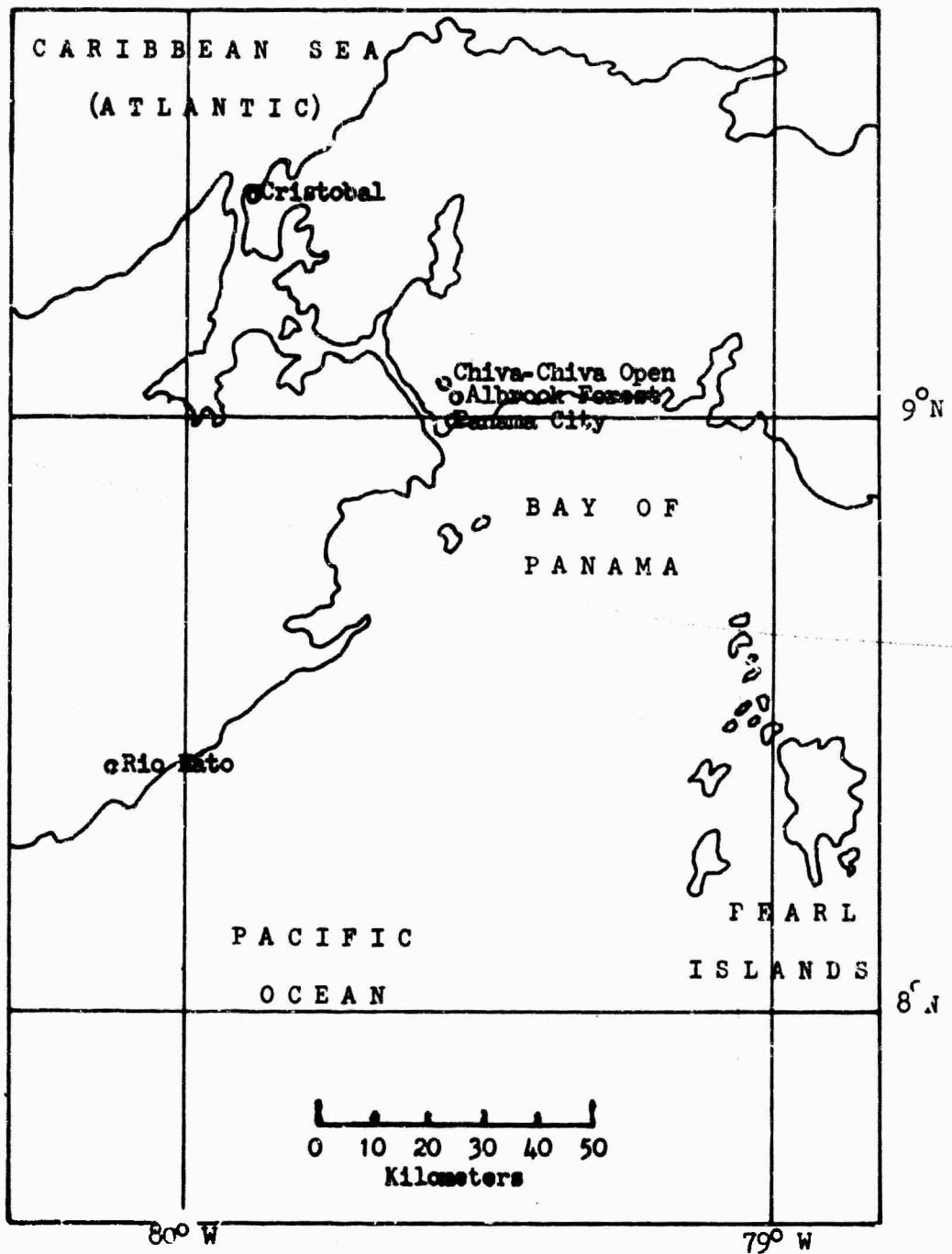


FIGURE 1. LOCATION MAP, Isthmus of Panama

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters)						Frequency
	0.5	1.0	2.0	4.0	8.0	13.5	
Temperature:							
Dry Bulb	-	1	1	1	2	1	-
Wet Bulb	-	1	-	1	-	-	-
Grass Minimum	3	-	-	-	-	-	-
WBGT Index	-	-	1	-	-	-	-
Relative Humidity	-	1	1	1	-	1	Hourly*/Continuously
Barometric Pressure	-	1	-	-	-	-	Hourly*/Continuously
Evaporation	-	1	-	-	2	2	Once Daily
Precipitation:							
Recording Gage	-	-	1	2	-	-	2 Continuously
Manual Gage	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	2	-	-	-	4 Times Daily
Wind:							
Direction	-	-	-	-	-	1	Continuously
Speed	-	3**	1	-	3**	1**	1 Hourly**/Continuously

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

Instrument descriptions are contained in the Environmental Data Base semiannual reports.

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

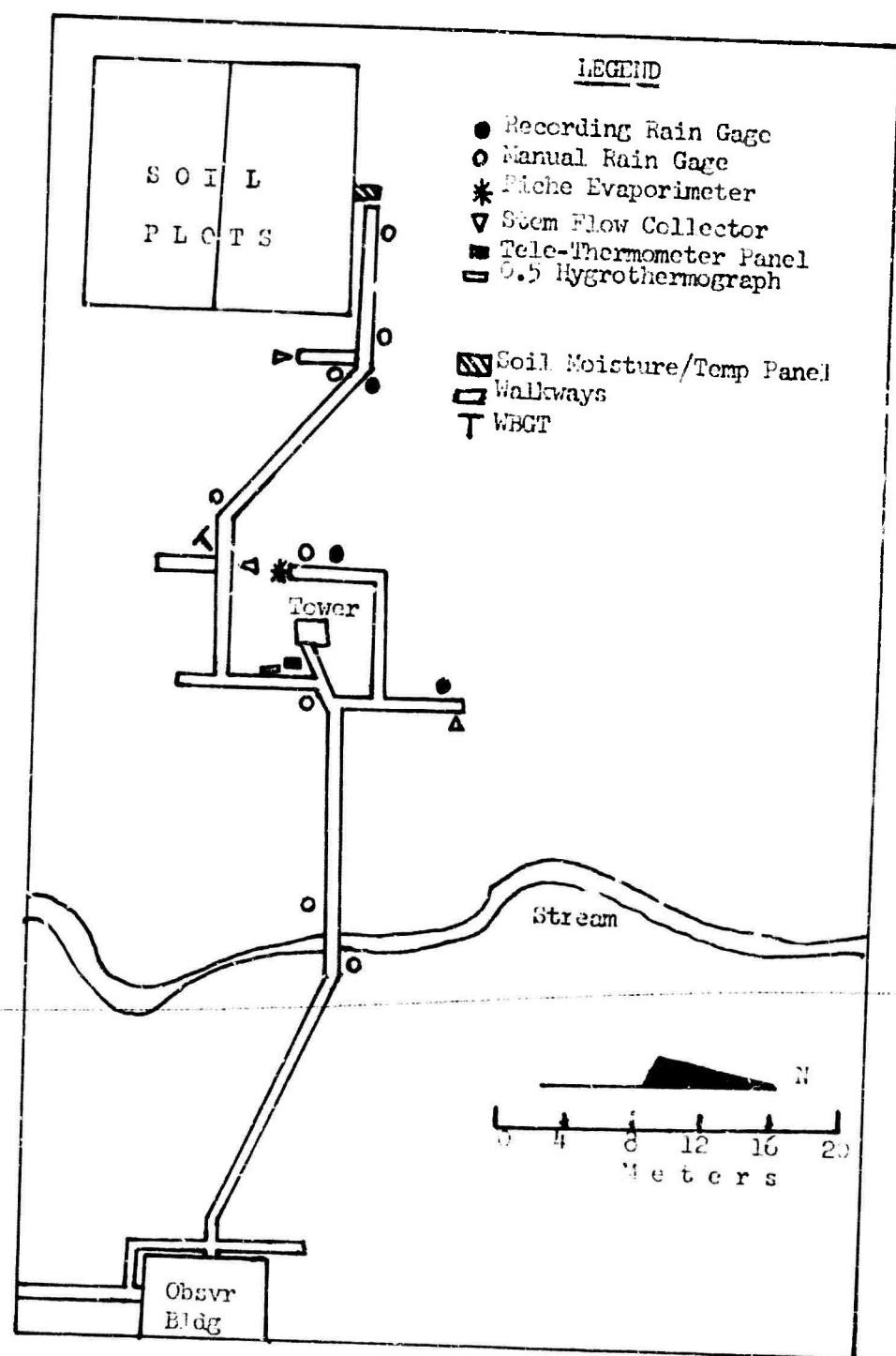


FIGURE 3. ALBECK FOREST SITE, GENERALIZED PLOT

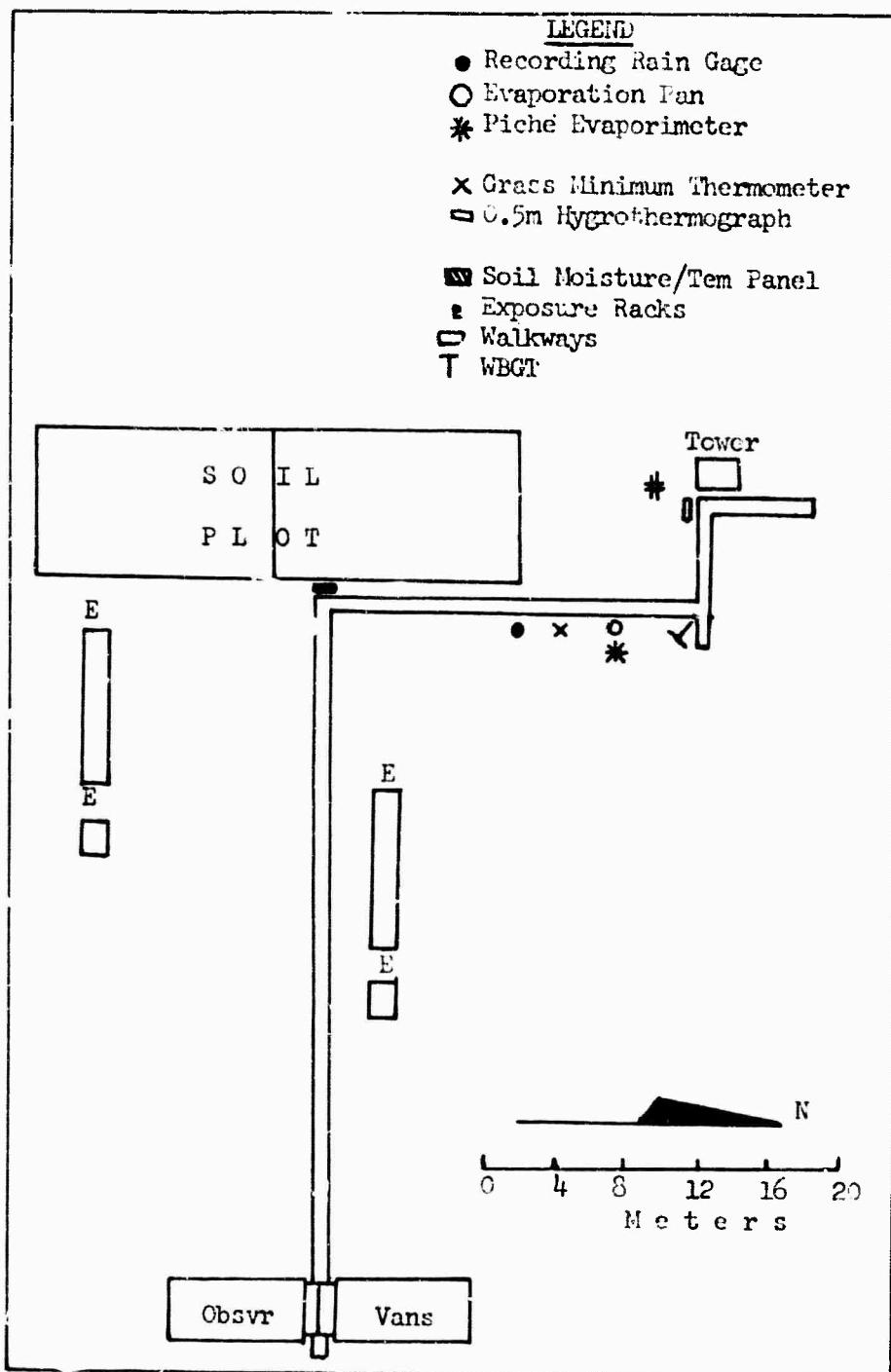


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

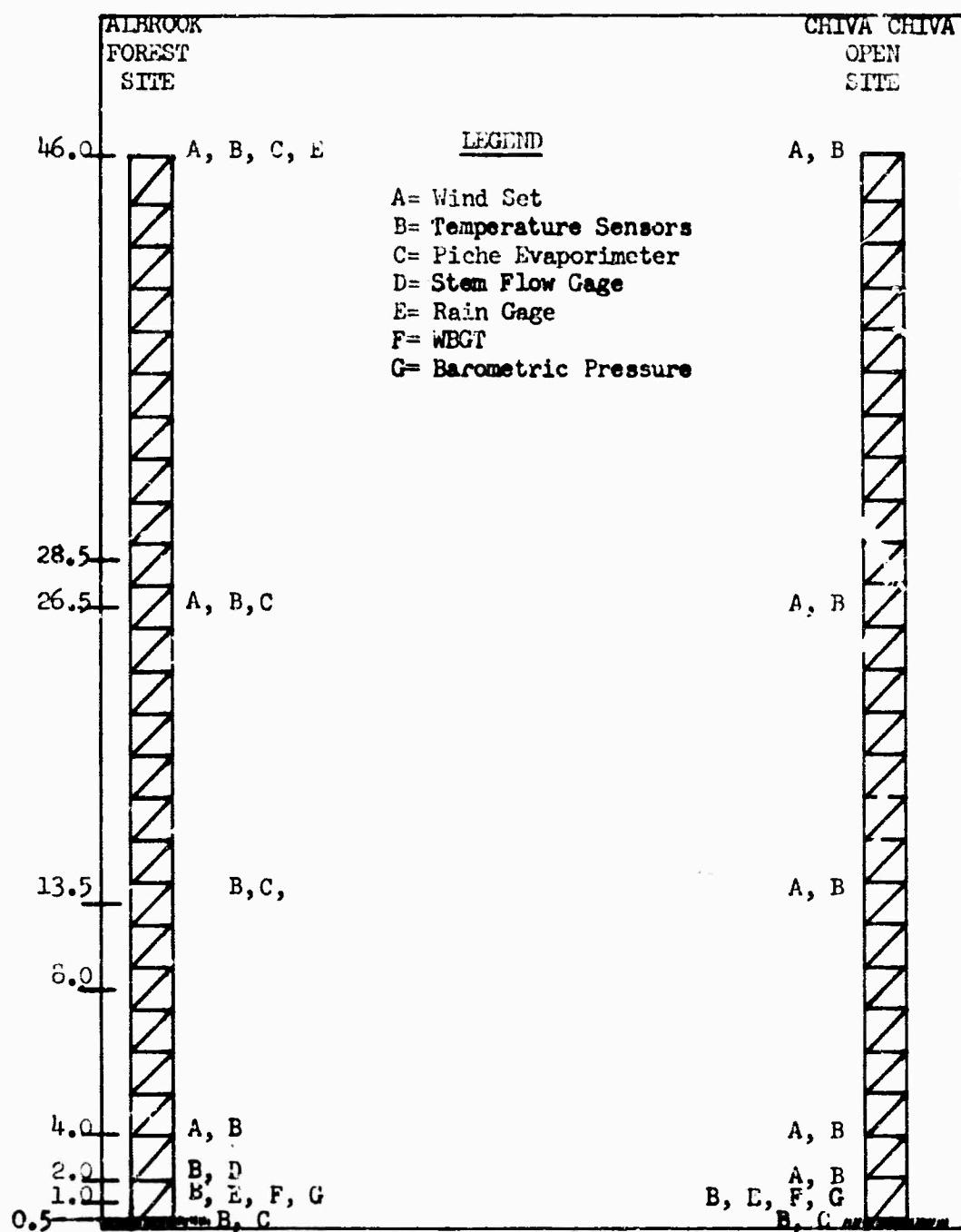


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N ₂ of Obs.	Min.	Mean	Max.
46.0 m	74.2	74.1	74.0	74.0	73.8	73.9	74.8	76.8	78.4	80.1	80.9	81.9	81.4	80.7	79.2	78.2	77.3	76.2	75.5	75.1	75.2	74.9	74.8	74.5	624	71.2	76.7	88.2	
28.5 m																													
26.5 m	74.3	74.3	74.2	74.2	74.2	74.2	75.1	77.0	79.0	80.6	81.5	82.2	81.9	81.7	80.3	79.4	78.2	76.9	75.7	75.3	75.1	74.9	74.8	74.6	624	71.8	77.1	88.9	
13.5 m	74.1	74.1	73.9	73.9	73.7	73.7	74.1	75.7	77.1	78.7	80.0	81.0	81.1	80.7	79.5	78.1	77.6	76.6	75.7	75.4	75.1	74.8	74.7	74.5	687	71.0	76.4	86.2	
8.0 m																													
Aldrook (Forest site)																													
4.0 m	73.8	73.8	73.7	73.7	73.6	73.5	74.1	76.0	77.6	79.1	80.1	80.9	81.1	80.3	79.1	77.8	76.9	76.0	75.5	75.1	74.7	74.6	74.4	74.1	719	59.7	76.2	86.2	
2.0 m	73.8	73.7	73.8	73.7	73.6	73.5	74.2	76.0	77.5	78.7	79.8	80.6	80.8	80.2	79	0	77.7	76.9	76.0	75.4	75.1	74.8	74.6	74.4	74.1	719	69.9	76.2	85.9
1.0 m	73.9	73.9	73.9	73.8	73.7	73.6	74.2	75.9	77.3	78.6	79.7	80.4	80.7	80.2	79.0	77.6	76.9	75.9	75.5	75.1	74.8	74.6	74.4	719	70.0	76.2	86.1		
0.5 m	74.3	74.3	74.3	74.2	74.2	74.3	74.0	75.6	77.1	78.2	79.2	79.9	80.4	80.1	79.2	78.2	77.6	76.8	76.2	75.9	75.5	75.3	75.1	74.8	713	71.0	76.5	84.1	
46.0 m	74.9	74.9	74.8	74.7	74.6	74.6	75.7	70.6	80.2	81.4	82.1	82.5	82.4	81.0	79.6	76.6	76.2	77.4	76.7	76.0	75.8	75.6	75.4	75.3	75.1	722	72.0	77.4	88.8
28.5 m																													
26.5 m	74.5	74.4	74.3	74.2	74.0	74.0	75.4	78.5	80.1	81.3	82.2	82.5	81.6	81.3	80.0	78.6	77.7	76.9	76.3	75.8	75.5	75.2	75.0	74.9	720	71.4	77.3	89.2	
13.5 m	74.5	74.4	74.3	74.3	74.2	74.2	75.4	78.5	80.2	81.6	82.3	82.7	82.7	81.5	80.5	80.0	78.6	77.6	77.0	76.1	75.7	75.4	75.2	75.0	74.8	714	71.3	77.3	89.9
8.0 m																													
4.0 m	74.0	74.0	73.8	73.8	73.8	73.8	73.8	73.2	76.1	79.0	80.9	83.0	83.8	84.2	84.2	82.6	80.9	79.1	78.2	77.3	76.0	75.6	75.2	74.9	74.4	717	70.2	77.7	89.2
2.0 m	73.9	73.9	73.7	73.7	73.6	73.7	73.6	76.1	78.9	81.0	83.0	84.3	84.3	84.2	82.8	81.0	79.2	78.1	77.1	75.9	75.4	75.0	74.7	74.2	717	70.4	77.6	89.1	
1.0 m	73.9	73.9	73.8	73.7	73.6	73.4	75.6	78.6	80.7	82.8	83.9	84.3	84.2	82.6	81.3	79.6	78.4	77.0	76.0	75.5	75.0	74.8	74.6	74.1	717	70.1	77.6	89.7	
0.5 m	73.7	73.8	73.6	73.5	73.5	73.5	75.6	78.8	80.8	83.0	84.2	84.8	84.3	83.0	81.7	79.7	78.7	77.1	75.9	75.5	75.1	74.9	74.7	74.6	74.1	717	69.7	77.6	90.2

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure	Site	Level	Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*	
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0m	4.9	4.5	4.5	4.5	4.1	4.3	5.5	7.7	8.9	10.6	11.0	10.9	15.6	14.3	16.9	13.4	10.2	9.0	8.2	7.0	7.6	7.0	6.5	5.7			
	28.5m																											
	26.5m	3.9	3.5	3.9	4.1	3.6	3.2	3.7	8.3	8.3	8.8	10.3	9.3	12.8	15.3	15.6	12.7	12.7	9.3	6.7	6.1	5.3	4.7	4.6	4.8			
	13.5m	5.4	5.4	5.1	5.3	5.3	5.2	4.7	5.8	5.8	7.9	7.7	10.0	9.7	12.3	13.1	10.7	10.0	8.9	8.1	6.9	5.9	5.9	5.9	5.9			
	8.0m																											
Albrook (Forest site)	4.0m	5.7	6.1	6.7	6.2	6.4	6.2	5.0	5.5	6.7	9.5	10.0	10.2	9.4	12.0	12.7	10.9	9.0	8.0	6.7	6.7	5.8	6.1	5.4	5.5			
	2.0m	5.5	5.9	6.6	6.3	6.0	6.3	5.3	5.8	6.5	9.2	9.7	10.0	8.9	11.5	12.0	10.8	7.7	7.4	6.0	6.3	5.5	6.0	5.0	5.5			
	1.0m	6.0	6.6	6.9	6.4	5.9	6.4	5.2	5.8	6.3	9.0	9.8	10.3	8.5	11.5	10.5	10.5	8.0	7.3	6.2	6.0	5.5	6.2	5.0	5.3			
	0.5m	5.7	5.1	5.9	5.2	5.5	5.5	4.8	6.0	5.4	6.8	7.7	7.8	7.4	8.8	9.6	9.1	8.0	7.3	6.6	5.7	5.5	5.8	5.3	5.8			

* No monthly summary
was computed for
the ranges.

Exposure	Site	Level	Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*	
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Chiva Chitva (Open site)	46.0m	4.2	4.2	4.2	4.2	4.1	3.9	5.2	10.8	14.8	13.3	13.6	12.5	10.4	15.7	15.9	11.7	9.4	8.7	7.4	6.9	6.5	6.0	4.6	4.3			
	28.5m																											
	26.5m	4.7	4.5	5.0	4.8	4.5	4.5	7.4	11.5	13.4	13.0	12.1	10.3	15.6	16.5	11.0	9.2	8.8	7.8	7.2	6.4	5.9	4.4	4.3				
	13.5m	4.5	4.2	4.8	4.8	4.5	4.5	6.5	11.9	12.7	13.3	11.6	11.8	9.2	13.6	16.9	11.5	9.2	8.4	7.1	5.9	5.5	4.9	4.4	4.4			
	8.0m																											
Chiva Chitva (Open site)	4.0m	5.6	6.6	7.1	6.3	5.9	6.1	7.4	10.4	12.6	13.2	13.1	10.5	10.9	15.8	16.9	12.1	10.9	9.6	8.1	6.9	6.3	6.2	5.5	6.6			
	2.0m	5.5	6.2	5.9	5.7	5.7	5.5	6.6	10.5	12.6	12.5	13.2	10.3	10.8	15.9	15.9	11.2	9.1	7.6	6.8	6.1	5.6	5.7	5.9				
	1.0m	5.8	6.3	6.5	6.2	6.5	5.8	6.5	12.3	11.6	11.2	13.2	12.5	11.2	17.7	16.3	14.3	12.2	9.3	8.3	7.0	6.3	5.7	5.4	5.7			
	0.5m	5.8	7.2	7.0	6.1	5.8	6.3	12.8	10.5	11.9	13.3	13.7	10.5	17.6	16.0	14.3	13.4	9.3	8.0	7.6	6.2	5.7	5.2	5.3				

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA

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Exposure		Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
46.0 m	95	95	95	95	95	95	95	95	93	88	82	80	78	79	80	82	85	88	90	93	93	94	94	95	95	623	62	90	97
28.5 m	97	96	97	96	97	97	96	97	97	96	93	88	83	81	79	79	81	83	87	90	93	96	96	97	96	622	63	91	98
26.5 m	97	97	97	97	97	97	97	97	97	96	94	90	87	84	83	85	86	89	91	93	95	96	97	97	97	689	70	93	99
13.5 m	97	97	97	97	97	97	97	97	97	97	96	94	90	87	84	83	85	86	89	91	93	95	96	97	97	689	70	93	99
8.0 m	This level was not instrumented for relative humidity at this time																									This level was not instrumented for relative humidity at this time			
4.0 m	98	98	98	98	98	97	96	94	90	88	86	85	87	89	90	93	95	96	97	98	97	97	97	97	97	719	70	94	100
2.0 m	98	98	98	98	98	97	97	95	91	90	88	86	87	89	91	94	96	96	97	97	97	97	98	98	98	719	73	95	100
1.0 m	98	98	98	98	98	98	98	97	96	93	91	90	88	89	90	93	94	96	96	97	98	97	97	97	97	719	74	95	100
0.5 m	98	98	98	98	98	98	98	97	97	95	94	93	91	91	92	93	94	96	97	97	98	97	97	98	97	713	78	96	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure	Site	Level	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*	
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albion Brook (Forest Site)	46.0 m	4	9	8	8	6	3	5	11	24	27	30	29	30	32	35	27	23	22	10	9	7	6	4	5			
	28.5 m	5	6	6	3	2	10	12	23	26	28	29	32	32	35	30	30	23	8	5	3	4	3	3				
	26.5 m	3	4	4	4	4	4	4	9	15	21	26	27	27	29	27	26	24	17	11	13	8	8	6	5			
	13.5 m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	9.0 m																											
	4.0 m	6	6	9	8	5	7	16	15	26	27	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29		
	2.0 m	5	7	8	8	5	7	14	15	24	26	27	27	27	27	27	27	26	22	17	14	9	8	7	8	9	6	
	1.0 m	6	5	7	8	8	6	8	14	10	23	22	25	23	26	21	19	16	14	9	8	8	8	8	10	6		
	0.5 m	7	5	4	5	4	6	6	6	8	14	15	21	16	19	21	19	18	7	8	6	6	5	6	6	8		

* No monthly summary
was computed for
the ranges.

Exposure	Site	Level	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Chiva Chiva (Open Site)	46.0 m	5	9	10	9	9	5	12	20	27	30	29	30	30	35	40	28	27	20	10	7	8	8	12	12		
	28.5 m	5	11	11	9	5	12	25	30	29	34	34	33	41	45	30	28	21	10	8	8	8	13	8			
	26.5 m	5	8	7	6	6	5	12	24	32	33	34	35	30	38	41	29	29	19	10	8	8	7	8	6		
	13.5 m	5	8	7	6	6	5	12	24	32	33	34	35	30	38	41	29	29	19	10	8	8	8	7	8		
	6.0 m																										
	4.0 m	8	14	15	12	10	6	15	21	27	32	30	30	26	38	42	31	27	23	15	12	14	11	10	10		
	2.0 m	5	12	14	11	7	5	12	22	27	33	31	30	23	38	39	31	26	20	14	10	9	9	9	6		
	1.0 m	4	8	8	6	6	5	10	26	37	35	34	32	27	39	42	29	27	20	8	9	7	7	5			
	0.5 m	6	11	10	8	9	5	13	25	25	31	34	37	27	38	35	31	30	21	13	12	9	8	7	6		

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure	Site Code ¹	Monthly Means ² of other Elements by Hour																								Monthly Summary			
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Mean	Max.	
WB (4.0 m)	73.4	73.4	73.3	73.3	73.2	73.1	73.7	75.2	76.3	76.7	77.2	77.5	77.3	77.0	76.4	75.6	75.3	75.0	74.7	74.5	74.2	74.0	73.9	73.7	719	69.6	74.9	79.7	
WB (2.0 m)	73.4	73.4	73.3	73.2	73.1	73.7	75.3	76.3	76.8	77.4	77.6	77.5	77.2	76.4	75.7	75.5	75.1	74.7	74.5	74.2	74.0	73.9	73.7	719	69.8	75.0	79.9		
WB (0.5 m)	74.1	74.0	73.9	73.9	73.8	73.7	73.7	75.0	76.4	77.1	77.9	78.2	78.2	77.9	77.3	76.6	76.3	75.9	75.5	75.2	74.9	74.7	74.5	74.3	713	70.7	75.5	80.7	
BP	.748	.736	.726	.722	.723	.729	.742	.756	.768	.772	.770	.758	.741	.724	.707	.700	.699	.708	.720	.737	.745	.758	.764	.761	.720	.640	.738	.825	
P1	0.05	0.09	0.01	0.00	0.50	0.00	0.01	0.16	0.08	0.04	0.03	0.17	0.43	0.13	0.11	0.05	0.12	0.16	0.02	0.03	0.01	0.03	0.01	71	0.01	6.99	9.85		
P2	0.04	0.04	0.01	0.00	0.13	0.01	0.02	0.02	0.17	0.06	0.08	0.08	0.22	0.09	0.06	0.02	0.11	0.11	0.02	0.02	0.01	0.03	0.00	49	0.01	3.56	4.41		
P3	0.05	0.05	0.03	0.00	0.40	0.00	0.00	0.25	0.12	0.05	0.01	0.05	0.45	0.22	0.07	0.02	0.08	0.22	0.02	0.02	0.01	0.00	0.00	36	0.01	4.05	8.80		
P4	0.05	0.15	0.03	0.01	0.18	0.05	0.30	0.05	0.32	0.11	0.03	0.02	0.11	0.75	0.28	0.14	0.02	0.08	0.06	0.01	0.01	0.00	0.00	46	0.01	5.31	9.75		

WB (4.0 m)	73.4	73.3	73.1	73.1	73.2	74.7	76.0	76.9	77.4	77.7	77.5	77.5	76.6	75.4	75.1	75.0	74.4	74.2	74.1	73.8	73.9	73.6	717	70.2	75.0	79.8		
WB (2.0 m)	73.4	73.3	73.1	73.0	73.1	74.8	76.0	77.0	77.4	77.8	77.7	77.6	76.8	76.1	75.4	75.1	74.9	74.4	74.2	74.1	73.8	73.8	73.6	717	69.8	75.0	79.4	
WB (0.5 m)	73.2	73.3	73.1	73.2	73.0	73.0	74.4	76.1	77.0	77.8	78.1	78.4	78.0	77.3	76.9	76.0	75.6	75.1	74.7	74.4	74.2	74.0	73.9	73.5	717	69.5	75.2	82.0
BP	.840	.826	.815	.813	.820	.835	.850	.862	.866	.861	.850	.832	.815	.796	.792	.793	.801	.828	.840	.856	.856	.851	.720	.730	.830	.920		
PS	0.05	0.10	0.02	0.01	0.25	0.14	0.12	0.03	0.05	0.09	0.06	0.02	0.23	0.50	0.15	0.11	0.05	0.08	0.09	0.08	0.04	0.03	0.01	0.00	69	0.01	6.21	9.65

WB - Wet bulb temperature (°F)
 BP - Barometric pressure (in. of Hg minus 29.0)

P3 - Precipitation under drip canopy (in.)
 P1 - Precipitation at 46.0 m. above canopy (in.)
 P2 - Precipitation under open canopy (in.)

² Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure	Site	Code	Monthly Ranges ² of other Elements by Hour																							Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WB (4.0 m)	WB	4.9	5.4	5.7	5.5	5.3	5.5	4.1	6.1	4.2	4.7	4.5	4.2	7.2	7.7	8.0	7.2	5.1	6.0	5.0	5.5	4.6	5.0	4.8	4.7	
WB (2.0 m)	WB	4.9	5.2	5.6	5.3	5.3	5.6	4.3	6.3	4.4	5.0	4.6	4.3	6.3	7.4	8.0	6.8	5.8	5.0	5.5	4.6	5.0	4.8	4.5		
WB (0.5 m)	WB	4.9	4.9	5.1	5.0	5.1	4.4	5.6	4.7	4.0	5.6	5.0	4.2	6.1	6.4	6.6	6.2	6.2	5.8	5.4	5.3	5.0	4.7	4.8		
BP	BP	.120	.095	.103	.100	.100	.100	.085	.095	.103	.115	.130	.130	.095	.090	.100	.120	.135	.140	.105	.105	.105	.105	.110	.095	
P1	P1	0.07	0.05	0.01	0.00	0.00	0.00	0.29	0.00	0.51	0.30	0.05	0.04	0.25	0.84	0.14	0.26	0.06	0.28	0.80	0.05	0.04	0.01	0.00	0.00	
P2	P2	0.00	0.04	0.00	0.00	0.23	0.00	0.00	0.00	0.27	0.08	0.11	0.00	0.13	0.39	0.13	0.15	0.02	0.29	0.34	0.02	0.01	0.00	0.00	0.00	
P3	P3	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.41	0.22	0.00	0.00	0.00	0.00	0.03	0.14	0.79	0.03	0.01	0.00	0.00	
P4	P4	0.00	0.00	0.02	0.00	0.00	0.51	0.00	0.36	0.00	0.56	0.27	0.07	0.01	0.19	0.00	0.45	0.21	0.01	0.18	0.06	0.00	0.00	0.00		

* No monthly summary
was computed for
the ranges.

Exposure	Site	Code	Monthly Ranges ² of other Elements by Hour																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
WB (4.0 m)	WB	4.6	5.1	4.9	5.1	4.9	5.3	4.7	5.1	5.3	5.4	4.4	4.0	5.4	9.0	8.6	6.6	4.8	5.5	4.9	5.5	4.8	4.4	4.7	5.0		
WB (2.0 m)	WB	4.8	5.0	5.3	4.6	4.6	4.5	4.8	5.2	5.1	4.8	4.3	3.5	5.9	7.8	7.8	6.5	5.0	5.2	4.5	5.0	4.5	4.1	4.4	4.8		
WB (0.5 m)	WB	4.8	5.9	5.7	5.3	5.5	5.3	4.8	6.2	4.8	5.2	4.9	5.2	8.7	9.7	10.1	7.7	5.5	5.2	5.2	5.5	5	4	4.9	5.0		
BP	BP	.110	.095	.090	.100	.100	.095	.080	.090	.100	.120	.100	.090	.085	.105	.105	.130	.140	.120	.110	.100	.100	.100	.090	.095		
PS	PS	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.09	0.12	0.09	0.01	0.64	0.00	0.25	0.35	0.07	0.19	0.54	0.13	0.06	0.03	0.00	0.00		

WB = Wet bulb temperature ($^{\circ}$ F)
BP = Barometric pressure (in. of Hg minus 29.0)
PS = Precipitation at 1.0 m. in open area (in.)
P1 = Precipitation at 46.0 m. above canopy (in.)
P2 = Precipitation under tree canopy (in.)
P3 = Precipitation under drip canopy (in.)
P4 = Precipitation under open canopy (in.)

² Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
 JUNE 1967

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
JUNE 1967

Exposure Site	Level	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albreck (Forest site)	46.0 m	8	10	11	12	8	12	14	17	17	14	20	17	20	18	13	13	14	16	15	16	13	10	9		
	28.5 m	6	9	5	8	5	9	7	9	8	12	8	11	10	10	9	9	11	13	11	7	8	8	6		
	26.5 m	4	7	6	7	6	7	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	
	13.5 m	4	7	7	6	7	6	9	6	9	10	13	10	16	11	10	9	6	5	6	7	8	7	5		
	8.0 m	0	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	1	1	1	1	1	1		
	4.0 m	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1		
	2.0 m																									
	1.0 m																									
	0.5 m																									

* No monthly summary
was computed for
the ranges.

CHIWA CHIWA (Open site)	Level	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albreck (Forest site)	46.0 m	7	13	10	10	10	9	13	11	12	10	17	11	16	10	14	13	10	8	11	12	13	10	10	8	
	28.5 m	6	7	8	7	7	10	10	9	8	13	10	15	12	15	13	10	7	8	9	9	9	8	7	5	
	26.5 m	4	7	7	6	7	6	9	6	9	10	13	10	16	11	10	9	6	5	6	10	5	8	6	4	
	13.5 m	4	7	7	6	7	6	9	6	9	10	13	10	16	11	10	9	6	5	6	10	5	8	6	4	
	8.0 m	0	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	1	1	1	2	1	1	1		
	4.0 m	4	7	7	5	6	5	8	7	8	8	12	8	12	10	7	7	6	6	6	7	7	5	4		
	2.0 m	2	3	3	4	2	5	5	5	6	9	6	10	7	6	4	3	3	3	5	3	4	3	2		
	1.0 m																									
	0.5 m																									

ALBROOK (Forest site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

	(%)																								
Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Drt.																									
N	6.9																								
NNNE																									
NT	3.4	3.4	6.9	3.4	13.7	6.9	7.2	3.5	3.5	3.4	3.4	3.7				3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	6.9	
ENE	6.9	3.4	6.9	10.1		7.2	10.7	6.9		3.7	3.7					6.9									
E	3.4	10.3	3.4			3.4	7.2	7.2		3.4	3.4						3.4	3.4	3.4	3.4	3.4	3.4	3.4	6.9	
ESB																									
SE																									
SSE																									
S																									
SSW																									
SW																									
WSW																									
W	6.9	20.6	13.7	13.7	13.7	10.3																			
WNW	20.6	3.4	17.2	20.6	10.3	17.2	3.5	21.4	10.7	24.0	6.9	3.7													
NW	17.2	17.2	10.3																						
NNW	6.9	6.9																							
CALM	27.5	41.2	27.5	37.8	27.5	20.6	42.8	35.6	14.2	20.6	10.3	3.7	7.4	10.3	10.3	20.6	13.7	20.6	24.0	24.0	24.0	24.0	24.0		

* Note: Due to rounding, percentage totals do not equal 100%.

ALBROOK (Forest site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hr.	3.5	3.5	3.5	7.2																				
N					3.5												3.5	3.5						
NNE						3.5											3.5	7.2						
NE						3.5											3.5							
ENE							3.5																	
E		3.5						7.4		3.5	11.1	7.4		10.7		3.5			3.5	3.5				
ESE									3.5	10.7			10.7		3.5	7.2		3.5						
SE									3.7	3.5			3.7		3.5				3.5					
SSE										3.7				3.7				3.5	3.5					
S	7.2	3.5	3.5		18.5	29.6	28.6	39.3	59.2	51.8	39.3	17.9	14.2	14.2	14.2	14.2	3.5							
SSW																			3.5	3.5				
SW											3.5		3.7		14.2		3.5							
WSW											7.2	7.2	3.5		3.5									
W	7.2	7.2									3.5	3.5	3.7		3.5									
WNW												3.5			10.7		7.2							
NW	14.2	7.2	7.2	10.7	17.9	10.7	14.8		3.7	7.2	7.2	3.7		7.2	3.5		7.2		3.5					
NNW	10.7	21.4	14.2										18.5	7.2	7.2	3.7		3.5	17.9	0.7	14.2	14.2	10.7	14.2
CALM	64.2	64.2	64.2										29.6	32.1	17.9	11.1		3.5		7.2	10.7	17.9	7.2	7.2

* Note: Due to rounding, percentage totals do not equal 100%.

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REPRODUCED BY MICROFILM

ALBROOK (Forest site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	3.4							3.5	3.4	3.4							3.4								
NNE							3.4									3.4	3.4	6.9	3.4					3.4	
NE								3.5	3.4	3.4						3.4	3.4	3.4							
ENE	3.4																3.4								
E										3.4	10.7	6.9													
ESE	3.4																								3.4
SE																	3.4	3.4	6.9	3.4					
SSE																	7.2	3.4							
S	3.4	3.4	3.4	3.5				17.2	24.0	20.6	35.6	35.6	34.3	10.3	3.4										
SSW										3.5															
SW								3.4			3.4	3.4					3.4	3.4							
WSW											3.4	3.4	3.4												
W		3.4	3.4	3.5																					
WNW		3.4									3.5						3.4								
NW	3.4																								
NNW																	3.5	6.9	3.4	3.4	3.4	3.4	3.4	3.4	
CALM	100.0	92.7	89.3	79.7	96.1	89.3	92.8	85.6	65.2	68.7	61.9	42.8	50.0	37.8	61.9	82.4	79.0	82.4	89.3	96.1	92.7	92.7	96.1		

* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.
(%)

Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	10.0	10.0	10.0	6.7	3.3		6.7	6.7	3.5		3.3	6.7		10.0	6.7	10.0		3.3	10.0	13.3	3.3	3.3	3.3	
NNE		3.3		6.7	3.3	6.7								3.3						6.7	6.7	3.3	3.3	3.3
NE	3.3	3.3	10.0	6.7	13.3	3.3		3.3	7.2	10.0	3.3	3.3								3.3		6.7	10.0	
ENE	13.3	3.3	10.0	3.3	3.3	6.7	6.7	3.3	5.7		6.7	3.3	6.7	3.3	3.3									6.7
E	.3	3.3	10.0	3.3	3.3	6.7	6.7	6.7	13.3	7.2		3.3	10.0	10.0	6.7				10.0	6.7	3.3	13.3	6.7	
ESE	3.3	6.7			3.3	3.3	6.7		3.5	3.3		6.7	3.3	3.3	6.7	10.0	6.7		3.3	3.3	3.3	3.3	3.3	
SE	3.3		3.3			3.3	6.7	20.0	14.2	20.0	23.3	10.0	16.7	20.0	13.3	10.0	6.7	3.3						
SSE		3.3							6.7	10.7	10.0	6.7	10.0	6.7	10.0	6.7	3.3	3.3		3.3	3.3	3.3	3.3	
S	3.3	6.7		6.7				3.3	6.7	6.7	7.2	20.0	23.3	20.0	10.0	3.3	6.7	6.7	3.3		3.3	3.3		
SSW		3.3	3.3	3.3	3.3						7.2	3.3	3.3				6.7	10.0	3.3					
SW	3.3	3.3	3.3	6.7		3.3			6.7			3.3		6.7		3.3	3.3			3.3	3.3			
WSW	6.7				3.3	3.3			3.5	10.0					3.3	3.3					3.3	3.3		
W	6.7	16.7	6.7	10.0	6.7	3.3	13.3	6.7	6.7	7.2	3.3	3.3	6.7	3.3	6.7	13.3	16.7		10.0	3.3	3.3	10.0		
WNW	16.7	6.7	6.7	23.3	20.0	3.3	6.7	6.7	10.7	3.3	6.7	6.7	13.3	3.3	10.0	10.0	3.3	16.7	10.0	20.0	13.3	13.3		
NW	40.0	36.7	30.0	20.0	26.7	33.3	30.0	30.0	33.3	20.0	14.2	6.7	13.3	13.3	20.0	26.7	23.3	36.7	23.3	26.7	40.0	30.0		
NNW	7.7	10.0	6.7	10.0	10.0	20.0	10.0	10.0	3.3	3.5	3.3	5.3	3.3	10.0	13.3	6.7	30.0	20.0	6.7	10.0	13.3			
CALM		3.3	3.3	3.3						3.3									3.3	3.3			3.3	

* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.

Dir.	(%)																								
	Hr. 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	6.7	10.0	10.0	10.0	16.7	6.7	10.0	6.7		3.3				3.3	13.3	6.7	3.3	6.7	16.7	16.7	13.3	13.3	3.3	3.3	
NNE	3.3	3.3	3.3	3.3	6.7	10.0	6.7	3.3						3.3	6.7	3.3	3.3						3.3	3.3	5.0
NE	10.0	10.0	6.7	6.7	6.7	3.3	10.0	3.3			6.9	6.7			3.3							6.7	6.7	3.3	
ENE	3.3	3.3	6.7	6.7	16.7	3.3	3.3	6.7	6.9	3.3	6.7			3.3								3.3	3.3	6.7	
E	3.3	3.3	5.3	10.0	3.3	3.3	13.3	16.7	10.0		16.7			6.7	10.0	6.7	3.3	6.7	3.3	6.7	3.3	6.7	3.3	13.3	
ESE	3.3	6.7	10.0		3.3			3.3	3.3	6.9			13.3	16.7	10.0	6.7	6.7	6.7	6.7	3.3	3.3	3.3	3.3		
SE	10.0	3.3	3.3	3.3	10.0	3.3	16.7	6.9	16.7					6.7	10.0	6.7	20.0	10.0	13.2	3.3	3.3	3.3	3.3	3.3	
SSE	3.3		3.3			3.3	6.7	13.3	17.2	10.0	20.0	10.0	10.0	13.3		6.7	6.7	6.7	6.7	3.3	6.7				
S			3.3				3.3	3.3	6.9	10.0	16.7	20.0	13.3	6.7	6.7	13.3				3.3	3.3	3.3	3.3		
SSW			3.3				3.3	6.9	6.7																
SW	3.3	3.3	6.7	10.0	3.3		3.3		6.7	6.7				6.7	6.7	3.3							13.3	10.0	
WSW	3.3		3.3						6.9	3.3	3.3			3.3	3.3								3.3	3.3	
W	10.0	10.0	10.0	6.7	6.7	6.7	3.3	13.7	6.7	10.0	10.0	3.3	13.3	6.7	3.3	13.3	10.0	13.3	3.3	3.3	3.3	3.3	3.3		
WNW	16.7	6.7	16.7	16.7	10.0	6.7	13.3	3.3	13.3	3.4	10.0			3.3	6.7	10.0	20.0	10.0	6.7	13.3	13.3	20.0			
NW	30.0	30.0	20.0	20.0	20.0	26.7	6.7	20.0	30.0	10.0	3.4	10.0	16.7	13.3	16.7	3.3	30.0	13.3	16.7	20.0	20.0	30.0	6.7		
NNW	6.7	6.7	10.0	6.7	13.3	13.3	20.0	23.3		6.7	6.9	3.3	6.7	10.0	16.7	3.3	3.3	10.0	13.3	20.0	16.7	10.0	13.3	16.7	
CALM	10.0	6.7	3.3	6.7	6.7	6.7	3.3	3.4		3.3				3.3				6.7	6.7	3.3	3.3				

* Note: Due to rounding, percentage totals do not equal 100%.

Interpolated & Averaged

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

	Hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Dir																											
N	13.3	13.3	3.3	10.0	6.7	6.7	13.3	6.7	13.3							3.3	6.7	26.7	3.3	3.3	16.7	13.3	6.7				
NNE	10.0	3.3	23.3	10.0	10.0		3.3	3.3		3.4	3.3					3.3	3.3				6.7	3.3	3.3	3.3	3.3		
NE	6.7	10.0	6.7	10.0	3.3	16.7	6.7	3.3	3.3	10.3	3.3						3.3			10.0	10.7	6.7	3.3	3.3			
ENE	6.7	6.7	3.3	3.3	10.0	13.3	3.3	3.3		10.0						3.3					3.3	3.3	3.3	6.7	13.3		
E	10.0	6.7	3.3		3.3		23.3	6.7	6.9	3.3	10.0	16.7	13.3	3.3		3.3			13.3			6.7		6.7			
ESE	3.3	3.3				13.3	3.3				3.3	6.7	3.3	13.3	6.7	10.0	10.0			3.3	3.3	6.7		6.7	3.3		
SE		6.7	3.3				3.3		20.0	10.3	13.3	10.0	20.0	13.3	13.3	10.0	6.7			6.7	3.3	3.3			3.3		
SSE	3.3	3.3	3.3	10.0	3.3		3.3	3.3	13.7	13.3	13.3	6.7	10.0	6.7	3.3			6.7			6.7					6.7	
S	3.3		3.3	3.3	6.7		3.3	10.0	13.7	20.0	16.7	16.7	3.3	3.3	10.0	23.3	3.3			3.3	3.3	3.3				3.3	
SSW		6.7	3.3		6.7	3.3				3.3	10.0				6.7			3.3									
SW	3.3			6.7			3.3	10.0			3.3				6.7			6.7									
WSW	3.3				10.0	3.3		3.3	6.7	3.3	6.9	10.0			6.7			6.7									
W	10.0					10.0	6.7	10.0	3.3	10.0	3.3	10.3	3.3	3.3	6.7	6.7	6.7	10.0	20.0	16.7	10.0	10.0					
WNW	16.7	10.0	10.0	13.3	13.3	10.0	10.0	3.3	6.7	6.7	3.3	10.0				13.3	16.7	10.0	5.7	20.0	13.3	10.0					
NW	13.3	16.7	23.3	16.7	23.3	10.0	6..	20.0	13.3	10.3	10.0				10.0	10.0	6.7	10.0	6.7	16.7	33.3	10.0					
NNW	6.7	6.7	2.3	6.7	13.3	13.3	16.7	26.7		0.3	10.2	6.7	10.0	13.3			20.0	10.0	13.3	10.0	3.3	13.3					
TOTAL	10.0	13.3	6.7	10.0	6.7	6.7				3.3	3.3	3.4						6.7	3.3	3.3	3.3	3.3	6.7				

* Note: Due to rounding, these totals do not equal 100%.

SUMMARY OF NON HOURLY DATA

JUNE 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index ¹ (at 1.0 meters)	Index value	419	70.1	76.7	82.4
		Dry bulb temp.	419	70.0	77.6)
		Wet bulb temp.	419	70.0	7.2	81.0
		Black bulb temp.	419	70.4	78.3	86.0
	Evaporation ³ (in. at 4 levels)	Piche (46.0 m)	27	0.024	4.848*	0.409
		Piche (26.5 m)	29	0.030	3.960*	0.317
		Piche (13.5 m)	22	0.006	1.182*	0.110
		Piche (0.5 m)	23	0.006	0.660*	0.140
	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1	23	0.01	2.36*	0.56
		Gauge # 2	28	0.01	4.16*	0.98
		Gauge # 3	30	0.01	5.33*	1.07
		Gauge # 4	28	0.01	7.30*	2.05
	Stem Flow ² (in. at 2.0 meters)	Gauge # 5	30	0.01	4.29*	1.00
		Gauge # 6	31	0.01	5.32*	1.07
		Gauge # 7	29	0.01	4.20*	1.00
		Gauge # 8	28	0.01	4.44*	0.94
Chiva Chiva (Open site)	WBGT Index ¹ (at 1.0 meters)	Small tree	24	0.01	4.42*	1.05
		Medium tree	21	0.01	3.67*	1.33
		Large tree	14	0.01	98.72*	45.38
		index value	421	70.1	79.6	93.1
	Evaporation ³ (in. at 0.5 meters)	Dry bulb temp.	421	70.2	80.4	92.0
		Wet bulb temp.	421	70.2	76.8	83.0
		Black bulb temp.	421	69.7	89.0	122.0
		Piche	30	0.006	3.810*	0.451
	Minimum Grass temp ³ (°F at grass tips)	Pan	27	0.004	5.596*	1.091
		None	22	69.3	72.2	75.0

1 - Hourly observations between 0600 and 1900 hours inclusive

* Total Values

2 - Six hourly observations

3 - Daily observations

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13. ABSTRACT This report contains detailed microclimatic data for June 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.		

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14. KEY WORDS	LINK A		LINK B		LINK C	
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Climate						
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Data Base						